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Supine Position Is Safe and Effective for Percutaneous Nephrolithotomy

MAN-TAT NG, M.D., WAI-HO SUN, M.D.,[1] CHI-WAI CHENG, M.D.,[1,2] and EDDIE SHU-YIN CHAN, M.D.[1,2]

ABSTRACT

***Background and Purpose*: The prone position has been widely adopted in conventional percutaneous nephrolithotomy (PCNL). Following its introduction in 1998, we changed our routine practice of PCNL from the prone to the supine position, which had numerous benefits and was safe and effective. Tract formation and stone fragmentation and retrieval were accomplished with the patient supine.**

***Patients and Methods*: We report our experience with 62 patients (67 renoureteral units) treated in the supine position and describe the technique in detail.**

***Results*: The primary stone clearance rate was 76%, and the mean number of sessions of PCNL was 1.3. There was no procedure-related major complication. There were also no splanchnic injuries. One kidney loss (emergency nephrectomy for control of hemorrhage) was noted but was not directly related to the procedure (profuse bleeding after accidental traction on the balloon nephrostomy tube by the patient 1 week after PCNL). Modification of positioning was made to suit the body build of Chinese patients.**

***Conclusion*: There are several advantages to the supine position for the patient and the urologist, with greater versatility of stone manipulation along the whole upper urinary tract. There are a few limitations of the supine position, but they can be overcome. Performing PCNL with the patient in the supine position is a sound alternative to the conventional prone position.**

INTRODUCTION

In 1955, GOODWIN AND ASSOCIATES described the technique of percutaneous renal access with the patient in the prone position. Later on, investigators developed techniques of tract dilatation and placement of working sheaths to allow instrumentation of the upper urinary tract. This marked the beginning of PCNL in 1977 (Fernström and Johansson). The more recent advent of shockwave lithotripsy (SWL) and ureterorenoscopy (URS) also had a great impact on the management of upper tract stones. Despite the availability of SWL and URS, PCNL is still the treatment of choice for large stone loads (e.g., stone $>$2 cm) or obstructed systems.

Classically, the patient is put in the prone position, which provides a larger surface area for choice of puncture site and a wider space for instrument manipulation. It was also thought that posterior puncture would minimize the risk of splanchnic injury. However, there are various drawbacks to this conventional technique. First, the patient needs to be in the supine position for retrograde ureteral catheterization then needs to be turned prone for the rest of the procedure. This change of posture is time consuming. However, the reader will be aware of the alternative of performing prone flexible cystoscopy that allows the whole procedure to be done in the prone position in one go, but this technique has its own limitation of being difficult to perform in the male patient.[1] Also, the prone position may be risky for some patients under general anesthesia. The problem of cardiopulmonary risk is well recognized, and it is even worse if the patient is already at high risk; e.g., morbidly obese. Moreover, the risk related to pressure points is more evident if the patient is prone. Sometimes, it is impossible for patients to be placed prone; e.g., because of hip or lower limb contractures. Needless to say, it is more comfortable and tolerable to the patient in the supine position if the procedure is per-

[1]Division of Urology, Department of Surgery, Alice Ho Miu Ling Nethersole Hospital, Tai Po, Hong Kong.
[2]Present address: Division of Urology, Department of Surgery, Prince of Wales Hospital, Shatin, Hong Kong.

formed under local anesthesia. Finally, in the conventional setting of prone position, the hands of the urologist are in the field of the fluoroscope, thus increasing the radiologic hazard to the medical personnel.

By doing PCNL with the patient in the supine position, the above disadvantages can be overcome.[2] The supine position also allows the patient to be put into a lithotomy position, which allows simultaneous retrograde instrumentation of the ureter, thus increasing the versatility of stone manipulation in the whole upper tract. This facilitates the treatment of complex cases (e.g., big renal stones together with obstructing ureteral stones) in one sitting.

Following Goodwin and associates, who created percutaneous nephrostomy (PCN) tracts with the patient prone, Almgard and Fernström in 1974 reported more lateral PCN placement with the patient in the supine-oblique position. Numerous studies were available to show the safety of lateral PCN placement[3–5] with the advent of more sophisticated imaging modalities that reviewed the relation of the PCN tract to the colon and other viscera.

Various modifications of patient positioning for PCNL then emerged as urologists understood more of the surface anatomy of the kidney and related viscera. These included the reverse lithotomy,[6] supine,[2] and lateral decubitus[7] positions. These options were shown to be safe and effective compared with conventional prone PCNL.

With the above background and the additional benefits of the supine position in mind, we adopted the supine position for all PCNLs since February 1999. The objectives of this paper are to present the technique of supine PCNL, our preliminary results, and the practical considerations related to this technique.

PATIENTS AND METHODS

Since February 1999, all PCNLs were performed with the patient in the supine position unless indicated otherwise. This paper is a review of hospital records and imaging from February 1999 to August 2002 for all 62 patients (67 renoureteral units) who underwent PCNL in the supine position (Tables 1–3). Patient demographics, stone characteristics, any obstructive uropathy attributable to urolithiasis, any existing PCN before PCNL, primary stone clearance, postoperative hospital stay, complications, auxiliary procedures after PCNL, and the total number of sessions of PCNL required to treat each renoureteral unit were recorded. Many of our patients initially presented with urosepsis secondary to obstruction by stones. These patients were initially managed by renal drainage and a full course of antibiotics. Thus, in our results, a high proportion of patients already had PCN tubes *in situ* before surgery. The problem of existing PCN tracts was that they might not be in the calix that would create the most effective and safe renal access for PCNL. However, *in situ* PCN tubes did not preclude additional puncture into another, more desirable, calix intraoperatively should this be deemed necessary. We have close liaison with our radiologists, and they created nephrostomy tracts with a more anterior skin puncture and horizontal direction so as to facilitate supine PCNL in the same tract.

All patients received prophylactic antibiotics according to preoperative culture results.

All primary PCNLs were performed with the patient under general anesthesia or high spinal anesthesia. Preferably, ventilation should be controlled for precise puncture. In our experience, spinal anesthesia with light sedation is just as effective as general anesthesia.

Patients were placed supine with the side harboring the stone close to the side of the operating table. The ipsilateral upper limb was hung by straps from a metal bar on the cephalic end of the table (Fig. 1) to provide more space so that the operating urologist could have more freedom during nephroscopy. The contralateral arm was adducted to the side of patient for the fluoroscope C-arm (Fig. 1). To improve the window for lateral access to the kidney and instrument manipulation, the ipsilateral flank was elevated with a 500-mL or 1000-mL saline bag according to the size of the patient (Fig. 1). The initial description of the technique[2] involved the use of a 3-L serum bag, but we found that smaller bags were usually adequate for our Chinese patients, who in general are slimmer and of smaller body build than Caucasian patients. If simultaneous retrograde URS was contemplated, the patient would be put into the supine lithotomy position (Fig. 2). Otherwise, the patient could remain supine for the whole procedure.

The PCN tracts were created by urologists. Surface marking of the lower ribs, costal margin, and iliac crest were done. Just before draping, ultrasonography was performed (Fig. 3). This was not routine in other experience, but we found it very useful in providing guidance and reassurance on puncture-site selection in relation to the stone and other splanchnic organs. If other organs were in the proposed needle path, a decision in favor of the prone position might be made immediately. In our

Table 1. Characteristics of Patients

Age (years)	Range 32–86; mean 55.9
M:F	34:33
Left:right	36:31
Obstructive uropathy (%)	57 (85)
PCN tube (%)	30 (45)

Table 2. Characteristics of Stones

	Range	*Mean*
No.	1–10	3.3
Size (max. diameter)(mm)	5–92	29.2
Size (area)(mm^2)	36–2670	607.5

Table 3. Location of Stones

	No
Renal pelvis	23
Upper ureter	23
Staghorn	10
UPJ	8
Caliceal	3
Total	67

FIG. 1. Patient in supine position on table. Ipsilateral arm is hung from bar to allow more room procedure (A). Saline bag is used to elevate ipsilateral flank (B). Towel roll is placed under knee to help expose perineum in female patient (C).

experience, no patient required the prone position because of the risk of visceral organ injury. The puncture site selected was usually anterior to the posterior axillary line (Fig. 4) and near the midaxillary line, and it was marked on the skin before draping. Ultrasonography was performed again after draping to double check if the previously marked skin entry site was still suitable because the position of the skin mark in relation to the renal unit may change (the skin over the flank area could be quite lax). A new skin puncture site might be selected. After the skin puncture site was confirmed with ultrasonography, the rest of the tracking was performed under real-time fluoroscopy.

After draping, retrograde catheterization of the ureter with a 5F ureteral catheter was performed with a flexible cystoscope. For female patients, this can be accomplished easily with slightly abducted hips. The collecting system was then distended and opacified with contrast medium mixed with blue dye. Further ultrasonography with aseptic technique was performed to reconfirm the puncture path. An 18-gauge puncture needle was then advanced into the chosen calix under real-time fluoroscopic control. Efflux of the blue dye indicated correct placement of the needle. In our experience, access to collecting system could be achieved in one or two punctures because of the ultrasound assessment done before the actual puncture. A 0.038-inch Terumo guidewire was then threaded into the system, preferably to coil inside the urinary bladder. An additional (safety) wire was used only if the first wire was not secure

FIG. 2. Patient in lithotomy position for simultaneous nephroscopic and ureteroscopic intervention.

FIG. 3. Operating urologist performing ultrasonography (A) to locate puncture site and path. Surface marking of costal margin (B).

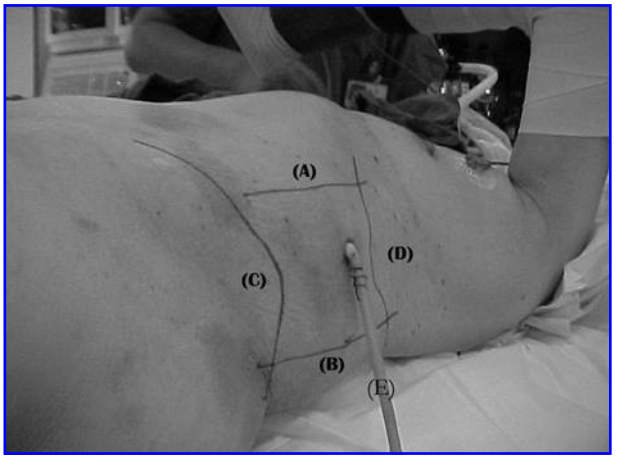

FIG. 4. Position of nephrostomy tube (E) in relation to anterior axillary line (A), posterior axillary line (B), iliac crest (C), and costal margin (D).

enough. Subsequent tract dilatation to 27F was accomplished with a set of metal telescopic dilators, and a 30F Amplatz sheath was used. Minipercutaneous puncture was performed in one patient.

Nephroscopy and stone fragmentation and retrieval were carried out in the usual fashion as in the prone position. We found that the Swiss Lithoclast™ with suction was a very effective device. A 22F or 24F nephrostomy tube was inserted at the end of the procedure, although no tube was placed (tubeless PCNL) in some straightforward cases (N = 3).

Postoperatively, stone clearance was documented by plain radiographs. Additional PCNL was performed with a flexible cystoscope under local anesthesia in some patients who had residual stone fragments or doubtful clearance because of an initial large stone load. This second-look procedure was liberally done 1 week afterward just before removal of the nephrostomy tube. This procedure was well tolerated even without any sedation or local anesthetic because it did not involve any dilatation or sheath placement. Occasionally, rigid nephroscopy without a working sheath was required for large residual stones necessitating fragmentation. In our experience, this procedure was well tolerated by patients with local skin anesthesia, most not requiring any systemic analgesia.

RESULTS

Most of the stones could be tackled satisfactorily with a single tract. Puncture via the lower pole was the commonest (56 renoureteral units), followed by a middle calix (9 renoureteral units). Multiple tracts were required in two cases, one with lower-pole and interpole punctures. In another patient, three punctures were created in two sessions: initially lower pole and midrenal punctures with the patient in the supine position and then an upper-pole puncture in the prone position in the second session. The number of PCNL(s) performed to treat each renoureteral unit ranged from 1 to 4 (mean 1.3). The mean primary stone clearance rate was 76%.

The postoperative hospital stay ranged from 1 to 135 days. One patient had a particularly long stay because of his multiple medical comorbidities. If this patient is included, the mean postoperative hospital stay was 10.7 days. If he is excluded, the mean postoperative hospital stay was 8.7 days.

One patient with an existing nephrostomy tube needed a new percutaneous access intraoperatively.

Ultrasonography was an adjunct to assess if there were any intervening viscera in the planned path of puncture. This imaging also was very valuable to help assess the angle of the path at the planned puncture site. The majority of the punctures were successful the first time.

Major complications directly related to the procedure were not noted. There was no retrorenal colon encountered in our series (by on-table ultrasonography), and there was no colonic perforation, as has been reported.[8] Postoperative fevers of $>38.5°C$ lasting for ≥ 2 days and necessitating a full course of antibiotics were observed in 12 patients (19.4%). One patient (the patient with three tracts) had severe hemorrhage after accidental traction on the balloon PCN tube in the upper pole 1 week after PCNL. She subsequently required emergency nephrectomy before embolization could be attempted. One patient had deep vein thrombosis of the lower limb. Only two patients required blood transfusion (transfusion rate 3%).

Simultaneous URS in the same session was performed in 24 patients for ureteral stones. One patient had contralateral URS for a lower ureteral stone. One patient had bladder, ureteral, and renal stones tackled simultaneously while in the same supine lithotomy position.

Two patients had severe multiple lower-limb deformities and contractures (one of whom had severe rheumatoid arthritis). The procedure was much facilitated by operating in the supine position. Two patients had severe cervical spondylosis (one of whom had severe rheumatoid arthritis). Only one patient with morbid obesity was encountered in our series.

Subsequent auxiliary procedures (SWL/URS) were used to clear the residual stone after PCNL(s) in 11 of the 67 renoureteral units (16.4%).

DISCUSSION

A PCNL is conventionally done with the patient in the prone position, and its safety and efficacy has been well documented. This position is conventional for historical reasons and because of fear of splanchnic injuries. As more urologists became familiar with the techniques of tract formation and subsequent stone removal, more variations of the techniques have been reported and practised.

The angle of entry was horizontal or slightly inclined anteriorly (up to about 10°) taking the plane of the operating table as horizontal (0°). A posterior calix was more commonly entered even though the site of puncture was near the midaxillary line and with the aforementioned angle of entry. This may be related to the more lean habitus of our subjects and because of the effect of the saline bag, which helped in elevating and rotating the kidney.

We have employed the supine position for PCNL for more than 3 years, and it has been very successful. We aimed at forming a tract through a posterior calix of the lower pole or mid

FIG. 5. Working sheath in relatively horizontal position or slightly downward inclination, allowing stone fragments to drop out spontaneously with irrigation fluid on withdrawal of nephroscope. Urologist can adopt more comfortable posture during procedure.

kidney, as there has been some concern about puncture of an anterior calix and subsequent higher risk of bleeding complications. This was not encountered in our practice, and our transfusion rate was low (3%). Nephrectomy was done in one patient who had bleeding from a tract in an upper calix formed with the patient in the prone position.

One patient with an existing nephrostomy tube needed a new percutaneous access intraoperatively. The nephrostomy tract had been created by a radiologist for emergency drainage for urosepsis, and the chosen calix was not the most desirable for stone clearance. Thus, a new portal of access was established intraoperatively.

From our experience, renal anatomy and stone position might change after preoperative drainage of an obstructed system but not in a predictable manner. Further evaluation with a larger series may be fruitful.

Splanchnic injury was not encountered in our series. It has been shown that intraperitoneal organs such as the spleen, liver, and colon are not in the way of puncture in the supine position. Puncture has been made safer in our series because we did ultrasound scans to locate our path. This is the reason we are doing skin punctures more anteriorly, even near the midaxillary line (Fig. 4). We found that nephroscopy is more efficient in a nearly horizontal tract.

The supine position offers several advantages. General anesthesia is less hazardous, especially in patients who have compromised cardiopulmonary function or severe cervical spondylosis, who are morbidly obese, and who need a prolonged procedure. Urologists are more comfortable adopting a sitting posture. Time is also saved in positioning and protecting pressure points. Moreover, because the tract is horizontal or slightly inclined downward to the outside, the pressure of the system is very low, and any stone fragments will tend to fall out through the working sheath spontaneously (Fig. 5). Effort and time thus are saved during stone retrieval. Because of the more dependent position of the calix in relation to the renal pelvis, the possibility of a stone falling into the renal pelvis and thus the ureter is minimized.

The supine position also allows greater versatility in stone management. This is reflected in our series, where simultaneous URS was done in 24 patients. One patient had URS for a contralateral ureteral stone, and one patient had simultaneous procedures for renal, ureteral, and bladder stones in the same single supine lithotomy position. The supine position greatly facilitates stone treatment in the whole urinary tract without changing the patient's position.

Despite these advantages, PCNL in the supine position has its own limitations and shortcomings. The pelvicaliceal system is constantly collapsed, and thus, nephroscopy tends to be more difficult. This can be overcome by tilting the table toward the contralateral side. Also, upper-pole caliceal puncture is impossible because the upper pole is more medial and posterior and concealed deeply in the rib cage. In our experience, however, upper-pole puncture is rarely necessary because of the possibility of ureteral access with simultaneous URS. Moreover, upper-pole puncture involves a higher risk of hydrothorax or pulmonary injury.

Although PCNL in the supine position is our routine practice, we did not exclude the prone position. Upper-pole puncture necessitates a prone position, as seen in one patient who finally had nephrectomy for bleeding. In some cases, the stone may become too tangential for nephroscopy and stone fragmentation during the initial PCNL in the supine position. Complete stone clearance may easily be achieved with a second PCNL via the same tract in the prone position under local anesthesia, as the kidney will then assume a different orientation.

Thus, the prone position is our complementary armamentarium. Urologists should be familiar with PCNL in both positions. The patient can always be turned into the prone position if intraoperative ultrasound scanning reveals viscera in the proposed path. However, we have not encountered any failure of tract formation in the supine position because of visceral organ interposition.

The practicing urologist should also be aware of new techniques of managing renal stones. Equipment for retrograde instrumentation and stone targeting and fragmentation is evolving. Alternatives to PCNL are now available. Nowadays, some renal calculi may be tackled by retrograde flexible ureterorenoscopy and holmium laser lithotripsy.[9] However, PCNL remains the standard for treating many renal and upper ureteral stones.

In short, the choice of intervention for renal stones is vast. As urologists, we should be familiar with the armamentarium we have. The selection for a particular patient should be based on the experience of urologist, the availability of equipment, and a discussion with the patient of the pros and cons of various techniques.

CONCLUSIONS

Performing PCNL with the patient in the supine position could simplify and streamline the whole procedure with additional benefits for patients and urologists. It also offers improved versatility of stone manipulation. The risk of iatrogenic splanchnic injury is minimal in our experience. The technique is safe, and it provides stone clearance rates comparable to those of conventional PCNL in the prone position. The technique can be mastered easily by urologists who are familiar with conventional PCNL in the prone position. Thus, PCNL in the supine position is a sound alternative to the conventional technique.

REFERENCES

1. Clayman RV, Bub P, Haaff E, Dresner S. Prone flexible cystoscopy: An adjunct to percutaneous stone removal. J Urol 1987;137: 65–67.
2. Valdivia JG, Valle J, Lopez JA, Villarroya S, Ambroj C, Ramirez M, Rodriguez JM, Sanchez MA. Technique and complications of percutaneous nephroscopy: Experience with 557 patients in the supine position. J Urol 1998;160:1975–1978.
3. Barbaric ZL, Hall Theodore, Cochran T, Heitz R, Schwartz A, Krasny M, Deseran W. Percutaneous nephrostomy: Placement under CT and fluoroscopy guidance. AJR Am J Roentgenol 1997;169:151–155.
4. Boon JM, Shinners B, Meiring JH. Variations of the position of the colon as applied to percutaneous nephrostomy. Surg Radiol Anat 2001;23:421–425.

5. Prassopoulos P, Gourtsoyiannis N, Cavouras D, Pantelidis N. A study of variation of colonic positioning in the pararenal space as shown by computed tomography. Eur J Radiol 1990;10:44–47.
6. Lehman T. Reverse lithotomy: Modified prone position for simultaneous nephroscopic and ureteroscopic procedures in women. Urology 1998;32:529–531.
7. Gofrit ON, Shapiro A, Donchin Y, Bloom AI, Shenfeld OZ, Landau EH, Pode D. Lateral decubitus position for percutaneous nephrolithotripsy in the morbidly obese or kyphotic patient. J Endourol 2002;16:383–386.
8. Vallancien G, Capdeville R, Veillon B, Charton M, Brisset JM. Colonic perforation during percutaneous nephrolithotomy. J Urol 1985;134:1185–1187.
9. El-Anany FG, Hammouda HM, Maghraby HA, Elakkad MA. Retrograde ureteropyeloscopic holmium laser lithotripsy for large renal calculi. BJU Int 2001;88:850–853.

Address reprint requests to:
Sun Wai-Ho, M.D.
Division of Urology
Dept. of Surgery
Alice Ho Miu Ling Nethersole Hospital
Tai Po
Hong Kong

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1. Brian Duty, Nikhil Waingankar, Zhamshid Okhunov, Eran Ben Levi, Arthur Smith, Zeph Okeke. 2011. Anatomical Variation Between the Prone, Supine, and Supine Oblique Positions on Computed Tomography: Implications for Percutaneous Nephrolithotomy Access. *Urology* . [CrossRef]
2. Mohammed Lezrek, Abdelghani Ammani, Khalil Bazine, Mohammed Assebane, El Hassan Kasmaoui, Abdelmounim Qarro, Amoqrane Beddouch, Mohammed Alami. 2011. The Split-leg Modified Lateral Position for Percutaneous Renal Surgery and Optimal Retrograde Access to the Upper Urinary Tract. *Urology* **78**:1, 217-220. [CrossRef]
3. Brian Duty, Zhamshid Okhunov, Arthur Smith, Zeph Okeke. 2011. The Debate Over Percutaneous Nephrolithotomy Positioning: A Comprehensive Review. *The Journal of Urology* **186**:1, 20-25. [CrossRef]
4. Siavash Falahatkar, Seyyed Alaeddin Asgari, Hamidreza Nasseh, Aliakbar Allahkhah, Fatemeh Jafari Farshami, Maryam Shakiba, Samaneh Esmaeili. 2011. Kidney displacement in complete supine PCNL is lower than prone PCNL. *Urological Research* **39**:3, 159-164. [CrossRef]
5. Cabir Alan, Hasan Koço#lu, Ferhat Ate#, Ahmet Re#it Ersay. 2011. Ultrasound-guided X-ray free percutaneous nephrolithotomy for treatment of simple stones in the flank position. *Urological Research* **39**:3, 205-212. [CrossRef]
6. Raed A. Azhar , Konrad M. Szymanski , Emmanuelle Lemercier , David Valenti , Sero Andonian , Maurice Anidjar . 2011. Visceral Organ-to-Percutaneous Tract Distance Is Shorter When Patients Are Placed in the Prone Position on Bolsters Compared with the Supine PositionVisceral Organ-to-Percutaneous Tract Distance Is Shorter When Patients Are Placed in the Prone Position on Bolsters Compared with the Supine Position. *Journal of Endourology* **25**:4, 687-690. [Abstract] [Full Text] [PDF] [PDF Plus]
7. András Hoznek, Julie Rode, Idir Ouzaid, Bernard Faraj, Michael Kimuli, Alexandre de la Taille, Laurent Salomon, Clément-Claude Abbou. 2011. Modified Supine Percutaneous Nephrolithotomy for Large Kidney and Ureteral Stones: Technique and Results. *European Urology* . [CrossRef]
8. Peng Wu, Li Wang, Kunjie Wang. 2011. Supine versus prone position in percutaneous nephrolithotomy for kidney calculi: a meta-analysis. *International Urology and Nephrology* **43**:1, 67-77. [CrossRef]
9. Ke-wei Xu, Jian Huang, Zheng-hui Guo, Tian-xin Lin, Cai-xai Zhang, Hao Liu, Jian Chun, You-sheng Yao, Jin-li Han, Hai Huang. 2011. Percutaneous nephrolithotomy in semisupine position: a modified approach for renal calculus. *Urological Research* . [CrossRef]
10. Hossein Karami , Alireza Rezaei , Mojtaba Mohammadhosseini , Babak Javanmard , Mohsen Mazloomfard , Behzad Lotfi . 2010. Ultrasonography-Guided Percutaneous Nephrolithotomy in the Flank Position Versus Fluoroscopy-Guided Percutaneous Nephrolithotomy in the Prone Position: A Comparative StudyUltrasonography-Guided Percutaneous Nephrolithotomy in the Flank Position Versus Fluoroscopy-Guided Percutaneous Nephrolithotomy in the Prone Position: A Comparative Study. *Journal of Endourology* **24**:8, 1357-1361. [Abstract] [Full Text] [PDF] [PDF Plus]
11. Abbas Basiri, Mehrdad Mohammadi Sichani, Seyed Reza Hosseini, Aliakbar Moradi Vadjargah, Nasser Shakhssalim, Amir Hossein Kashi, Mohammadreza Kamranmanesh, Hamidreza Nasseh. 2010. X-ray-free percutaneous nephrolithotomy in supine position with ultrasound guidance. *World Journal of Urology* **28**:2, 239-244. [CrossRef]
12. Siavash Falahatkar, Aliakbar Allahkah. 2010. Recent Developments in Percutaneous Nephrolithotomy: Benefits of the Complete Supine Position. *UroToday International Journal* **03**:02. . [CrossRef]
13. A. Andrew Ray , Dae-Gyun Chung , R. John D'A. Honey . 2009. Percutaneous Nephrolithotomy in the Prone and Prone-Flexed Positions: Anatomic ConsiderationsPercutaneous Nephrolithotomy in the Prone and Prone-Flexed Positions: Anatomic Considerations. *Journal of Endourology* **23**:10, 1607-1614. [Abstract] [PDF] [PDF Plus]
14. Jose Gabriel Valdivia Uria. 2009. Complete Supine Percutaneous Nephrolithotripsy Comparison With the Prone Standard Technique: The Time for Change From Prone to Supine Position Has Come. *UroToday International Journal* **02**:02. . [CrossRef]
15. Jean J.M.C.H. de la Rosette, Peter Tsakiris, Michael N. Ferrandino, Ahmed M. Elsakka, Jorge Rioja, Glenn M. Preminger. 2008. Beyond Prone Position in Percutaneous Nephrolithotomy: A Comprehensive Review. *European Urology* **54**:6, 1262-1269. [CrossRef]
16. Cesare M. Scoffone, Cecilia M. Cracco, Marco Cossu, Susanna Grande, Massimiliano Poggio, Roberto M. Scarpa. 2008. Endoscopic Combined Intrarenal Surgery in Galdakao-Modified Supine Valdivia Position: A New Standard for Percutaneous Nephrolithotomy?. *European Urology* **54**:6, 1393-1403. [CrossRef]
17. Siavash Falahatkar , Amin Afshari Moghaddam , Mohammad Salehi , Sara Nikpour , Fereshteh Esmaili , Negin Khaki . 2008. Complete Supine Percutaneous Nephrolithotripsy Comparison with the Prone Standard TechniqueComplete Supine Percutaneous Nephrolithotripsy Comparison with the Prone Standard Technique. *Journal of Endourology* **22**:11, 2513-2518. [Abstract] [PDF] [PDF Plus]
18. Abbas Basiri , Seyed Amir Mohsen Ziaee , Hamidreza Nasseh , Mohammadreza Kamranmanesh , Parham Masoudy , Fatemeh Heidary , Hamidreza Kianian , Mehdi Abedinzadeh . 2008. Totally Ultrasonography-Guided Percutaneous

Nephrolithotomy in the Flank PositionTotally Ultrasonography-Guided Percutaneous Nephrolithotomy in the Flank Position. *Journal of Endourology* **22**:7, 1453-1458. [Abstract] [PDF] [PDF Plus]

19. Marco De Sio, Riccardo Autorino, Giuseppe Quarto, Francesco Calabrò, Rocco Damiano, Francesco Giugliano, Salvatore Mordente, Massimo D'Armiento. 2008. Modified Supine versus Prone Position in Percutaneous Nephrolithotomy for Renal Stones Treatable with a Single Percutaneous Access: A Prospective Randomized Trial. *European Urology* **54**:1, 196-203. [CrossRef]
20. Denby Steele , Villis Marshall . 2007. Percutaneous Nephrolithotomy in the Supine Position: A Neglected Approach? Percutaneous Nephrolithotomy in the Supine Position: A Neglected Approach?. *Journal of Endourology* **21**:12, 1433-1438. [Abstract] [PDF] [PDF Plus]
21. Gaspar Ibarluzea, Cesare M. Scoffone, Cecilia M. Cracco, Massimiliano Poggio, Francesco Porpiglia, Carlo Terrone, Ander Astobieta, Isabel Camargo, Mikel Gamarra, Augusto Tempia, Josè G. Valdivia Uria, Roberto Mario Scarpa. 2007. Supine Valdivia and modified lithotomy position for simultaneous anterograde and retrograde endourological access. *BJU International* **100**:1, 233-236. [CrossRef]
22. Elias Assad Chedid Neto, Anuar Ibrahim Mitre, Cristiano Mendes Gomes, Marco Antonio Arap, Miguel Srougi. 2007. Percutaneous Nephrolithotripsy With the Patient in a Modified Supine Position. *The Journal of Urology* **178**:1, 165-168. [CrossRef]
23. Maurice Stephan Michel, Lutz Trojan, Jens Jochen Rassweiler. 2007. Complications in Percutaneous Nephrolithotomy. *European Urology* **51**:4, 899-906. [CrossRef]
24. Luigi Cormio, Pasquale Annese, Tommaso Corvasce, Mario De Siati, Francesco P. Turri, Fabrizio Lorusso, Salvatore Pentimone, Antonia Perrone, Giuseppe Carrieri. 2007. Percutaneous Nephrostomy in Supine Position. *Urology* **69**:2, 377-380. [CrossRef]
25. T. Manohar , Prashant Jain , Mahesh Desai . 2007. Supine Percutaneous Nephrolithotomy: Effective Approach to High-Risk and Morbidly Obese PatientsSupine Percutaneous Nephrolithotomy: Effective Approach to High-Risk and Morbidly Obese Patients. *Journal of Endourology* **21**:1, 44-49. [Abstract] [PDF] [PDF Plus]